An Application of the AHP in Cultural Heritage Conservation Strategy for China[1]

APPLICATION DE L'AHP A LA STRATEGIE DE CONSERVATION DE L'HERITAGE CULTUREL DE LA CHINE

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Abstract: How to establish a comprehensive conservation strategy for China's cultural heritage conservation has not yet been paid attention. Nowadays cultural heritage conservation involves more and more factors and gradually turns into a complex multi-criteria decision problem, which brings many difficulties to strategy-making. The Analytic Hierarchy Process (AHP) can be very useful in reaching a likely result which can satisfy the decision makers. With the help of the foundation funded by the Ministry of Education and the State Archives Administration of China, this paper is intended to investigate the feasibility of applying the AHP in cultural heritage conservation to improve the decision making with a more systematic and logical approach. First, the important criteria and alternatives for cultural heritage conservation were identified. These criteria and alternatives were used to formulate an AHP-based model to represent the strategy making aspects. Then the AHP-based model was analyzed, and finally some conclusions were obtained, such as "restoration technology is emergent", "technological application is important", etc.
Key words: cultural heritage, conservation strategy, AHP

Résumé: Comment établir une stratégie globale de conservation pour l'héritage culturel chinois n'a pas fait l'objet d'une grande attention. Aujourd'hui, la conservation de l'héritage culturel comprend de plus en plus de facteurs et devient progressivement un problème de décision complexe à multi-critères qui entraîne beaucoup de difficultés pour la prise de stratégie. Le Processus de la hiérarchie analytique (Analytic Hierarchy Process/AHP) est très utile pour chercher un résultat qui pourrait satisfaire ceux qui prennent la décision. Avec l'aide de la fondation financée par le ministère de l'Education et l'Administration nationale des archives de la Chine, cet article essaie d'étudier la feasibilité d'appliquer l'AHP à la conservation de l'héritage culturel de sorte à faciliter la prise de décision avec une approche plus systématique et logique. Tout d'abord, les critères et alternatives importants pour la conservation de l'héritage culturel étaient identifiés. Ils étaient utilisés pour formuler un modèle basé sur l'AHP dans le but de représenter les aspects de la prise de stratégie. Ensuite, ce modèle était analysé, et finalement on obtenait des conclusions, comme « la restauration technologique est émergente », « l'application de la technologie est importante » etc.
Mots-Clés: héritage culturel, stratégie de la conservation, AHP

1. INTRODUCTION

China's cultural heritage, whether immovable or movable, is rooted in one of the world's oldest cultures and of very great importance to comprehend Chinese history as well as the daily life of contemporary China. The latest official statistics by State Administration of Cultural Heritage shows that there are nearly 400,000 immovable cultural heritage objects and about 12,000,000 movable cultural heritage objects, which represents China's abundant cultural heritage collections.

The accumulation of cultural heritage objects

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certainly leads to some conservation and restoration problems. The longer these objects stored, the more problems involved. The conservation and restoration organized by the government dated back to Zhou dynasty（1100 B.C.- 256 B.C.）, and gradually formed the tradition of technological treatments. However, the application of conservation and restoration technology is not omnipotent in terms of conservation. Modern practice proves that other factors such as policies and laws now also function in protecting these cultural heritage collections. How to comprehensively evaluate the most influential factors and to accordingly form a comprehensive strategy so as to guide the conservation practice has not yet established till now in China, while its counterparts like the European countries and Australia have already taken actions. Therefore, it's of great meaning to form a strategy in China with its luxuriant cultural heritage collections.

To solve China's problem, the first thing needs to systematically evaluate the major factors that influence the efficiency of cultural heritage conservation. By the foundation funded by the Ministry of Education and the State Archives Administration of China, the author investigated 20 Chinese experts such as senior conservators, conservation administrators, conservation scientists and educators, then used The Analytic Hierarchy Process (AHP), a theory set up by T. Satty in 1970s, to systematically compare and determine the priorities of the criteria and alternatives, which can help the decision maker choose the conservation strategy more effectively.

2. IDENTIFYING THE CRITERIA AND ALTERNATIVES

Criteria and alternatives are indispensable to form AHP-based model for cultural conservation. In brief, they mean all kinds of factors to bring about a result for cultural heritage conservation. Different people have different opinions on them, whether inner or external, natural or artificial, social or individual, professional or nonprofessional. From a survey conducted in the Archives Conservation Committee of China's Archives Society, the author identified the criteria shown below.

Technological aspect:

·Conservation

·Restoration

Non-technological aspect:

·Social consciousness

·Conservation law

·Conservation policy

·Conservation research

·Professional education

·Economic devotion

The above identified factors are now considered as the relevant criteria and alternatives and can be used to formulate an appropriate AHP model for making a satisfying cultural heritage conservation strategy.

3. THE AHP-BASED MODEL

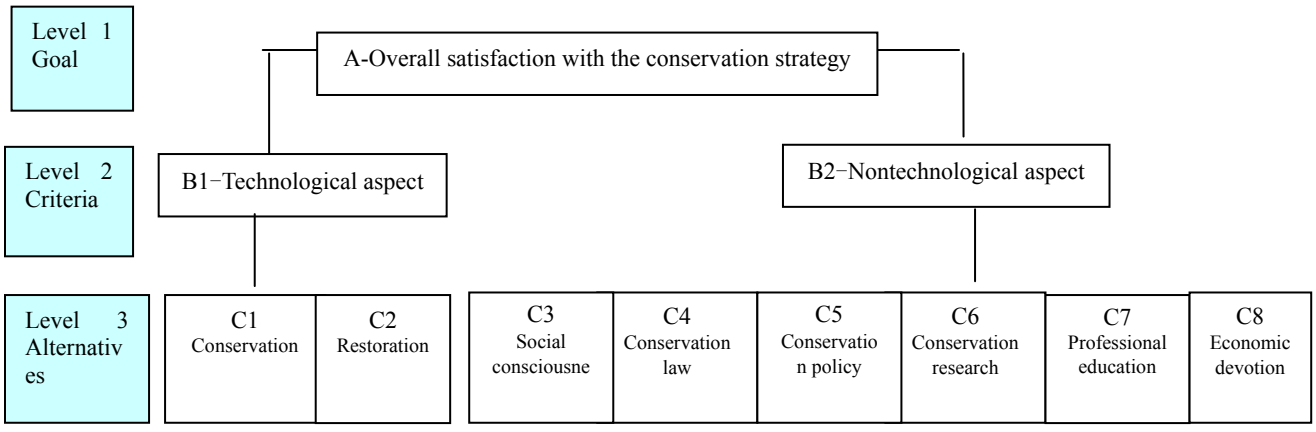
3.1. Structure strategy-making problem

In this phase, the author will formulate an appropriate hierarchy of the AHP model consisting of the goal, criteria and the alternatives. The goal, which is placed on the first level as shown in figure 1, is to express the conservation system and its overall satisfaction.

The second level of the hierarchy is occupied by the criteria to achieve the goal. There are two criteria related to the destination, as analyzed above, namely technological aspect and non-technological aspect.

The lowest level of the hierarchy consists of the alternatives, namely the different conservation policies. In general, they are the major factors which influence the efficiency of conservation in a direct or indirect way. The AHP model shown in figure 1 can assess the strategy by the rating scheme and determine the strategy priority weights to select the best one.

Figure 1 an AHP-based model



3.2. Measurement and data collection

This phase involves collecting pairwise comparisons to the criteria and alternatives in the AHP model. 20 Chinese senior conservators, conservation administrators, scientists and educators were invited to assign their pairwise comparisons, which would be translated into the corresponding pairwise comparison judgment matrices（PCJM）. A questionnaire consisting of all the criteria and the alternatives in AHP model is designed and used to collect the pairwise comparison judgments from those being invited. They gave the pairewise comparison judgments of all criteria pairs and alternatives that have the same criteria in the second and third level. The pairwise comparison judgments are made with respect to attributes of one level of hierarchy given the attribute of next higher level of hierarchy. The results collected from the questionnaires are used to form the corresponding pairwise comparison judgment matrices（PCJMs） for determining the normalized weights as explained in the following section .

3.3. Calculating the consistency ratio

As explained in section 3.1, we will obtain the corresponding pairwise comparison judgment matrices. Each of these matrices is then translated into the corresponding largest eigenvalue problem and is solved to find the normalized and priority weights for each criterion as shown in Table 1. With the sum-approach , we can determine the normalized priority weights. Then we should calculate the consistency ratio (CR) of each PCJM, which should be compared with the rule-of-thumb value of C.R(RCR). If the calculated CR is well below the corresponding RCR, it clearly implies that the expert decision maker is consistent in assigning pairwise comparison judgments. Otherwise, the PCJMs are invalid and should be reassigned by the decision maker. In this process, 18 questionnaires passed the CR examination and could be used for the calculation of next step.

3.4. Determining priority weighs

With the 18 questionnaires, the author adopts the normalized priority weights to calculate the evaluation of each criterion and alternative by following the brief steps of AHP.

First take the 18 forms as samples and use the judging matrix $A_k=(a_{ijk})$ to calculate individual vectors by adopting the formulae $\omega_k=(w_{1k},w_{2k},\ldots,w_{nk})^T$, k=1，2，…，s. Then, calculate the priority weighs.

$\omega=(w_1,w_2,\ldots,w_n)^T$

$\overline{w}_j=w_j/\sum w_i$

$\overline{w}_j=(w_{j1})^{\lambda 1}\cdot(w_{j2})^{\lambda 2}\cdot\ldots\cdot(w_{js})^{\lambda n}$

Presume the equal priority weighs,$\lambda_1=\lambda_2=\ldots=\lambda_s$, and get the following formulae:

$\overline{w}_j=(w_{j1}\cdot w_{j2}\ldots w_{js})^{1/s}$

(i= j=1,2,…,n； n=8； s=18)

By the calculation, the result is shown in Table 1 and Table 2.

Table 1 Priority weights for each criterion

Index	Technological aspect	Non-technological aspect	Gross priority	Average
Mark	B1	B2	$\sum \overline{B}_{k=1}$ (k=1,2)	0.500
Priority weights	0.36	0.64		
Order	2	1		

Table 2 Priority weights for each alternative

Index	Conservation	Restoration	Social consciousness	Conservation laws	Conservation policy
Mark	C1	C2	C3	C4	C5
Weights	0.18	0.22	0.06	0.14	0.10
Order	2	1	7	4	5

Index	Conservation research	Professional education	Economic devotion	Gross priority	Average
Mark	C6	C7	C8	$\sum \overline{C}_{k=1}$ (k=1,8)	0.125
Weights	0.08	0.05	0.17		
Order	6	8	3		

With the above calculated priority weights of each criterion and alternative, a conservation strategy is formed accordingly.

4. DISCUSSION

As explained in Section 1, China has formed the tradition of technological application during its long history of cultural heritage conservation. However, modern

conservation of cultural heritage involves more factors than technological application, which makes cultural heritage conservation more complex than ever before. How to consider all these factors and develop a conservation strategy is a new but important idea to the administrative departments as well as to the individual institute. With the help of national foundations and conservation experts, the author first investigated the influential factors to the cultural heritage conservation as criteria and alternatives, and then, formulated an AHP-based model, as shown in figure 1, which is used to select the conservation strategy of cultural heritage. Following the steps of AHP, the result of priority weights for each criterion and alternative is easily obtained. With the increase of the number of criteria and alternatives, as well as the data collected in this investigation, this result may have a change. In fact, the author can increase the number of evaluators, recollect data and redetermine the priority weights to examine whether it is changed or not. However, the result in this paper can be still of significance for the strategy making of cultural heritage conservation in China today.

4.1. Emergent restoration policy

As shown in table 2, the priority of restoration is 0.22, taking the lead among all alternatives. This can account for the emergency of the application of restoration technologies. The result also reflects the modern practical need of China. It's estimated that it will take at least two thousand five hundred years to restore all the destroyed objects in different institutes by international standard at the speed of one object per master per month. Thus restoration has already caused wide attention and becomes the most imperative aspect during the long preservation of cultural heritage collections.

4.2. Technological application policy

The priority of technological aspects, including conservation and restoration, takes 0.40 and each is higher than the average weight, as shown in table 1, which no doubt establishes its priority during the course of cultural heritage conservation. "Conservation first and then the integration of conservation and restoration" was set up as the most important conservation guideline since 1949 in China. The past practice has proved its validity. Guided by it, numerous objects were preserved and a lot of them were protected from their severe danger. Whether in the past, at present or in the future, the technological application concerning conservation and restoration will be least doubtfully dominant to prolong the life of any cultural heritage object.

4.3. Indispensable Financial policy

Not only the special technologies but also the economic devotion is needed to effectively preserve the collections. Past experience shows that there has never been a time of "enough" money for cultural heritage conservation both for private and for public institutes. This can explain why economic devotion has so important a priority, the third one shown in table 2. In fact, individuals and enterprises are more than willing to spend money on conservation, but compared with mint capital needed for conservation and restoration cultural heritage collections, this devotion is scanty. So the Cultural Heritage Conservation Fund donated by individuals, enterprises and organizations is insufficient; the national financial appropriation is more effective.

4.4. All-round development policy

Different alternatives have different priorities, as shown in table 2. It means that, during the course of heritage conservation, these alternatives should not be ignored; otherwise cultural heritage conservation will be more or less affected. So an overall social and economic integration of all these alternatives such as conservation consciousness, conservation law and policy, conservation research and education is needed. In China, cultural heritage objects are largely distributed and thus their conservation has caused a lot of problems, like the increasing lack of professional management, conservation organization, conservation policy, conservation professionals and conservation standard, etc. In a word, China has to face this present austere situation caused by the lack on non-technological aspects. So it's high time that China realize these problems and have further reform. The most pressing task is to establish a specialized administrative organization such as inter-departmental conservation committee, to reengineer its departmental conservation organizations such as conservation team, and to set up the national and provincial conservation research institutes, etc. in order to meet the needs of cultural heritage conservation.

Different countries have their own cultural heritage conservation strategies, like the European Preventive Conservation Strategy and the Conservation and Preservation of Australia's Movable Cultural Heritage. For China, it's high time to establish its own cultural heritage conservation strategy. This article only puts forward some suggestions for this strategy. Furthermore, for every individual institute in China, its heritage objects' value, its storage condition and its imposed technologies are not always the same, which certainly leads to the differences in conservation strategy-making. This is a problem worth of further studying in practice.

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